(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 061 918**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 82301629.0

(22) Date of filing: 29.03.82

(51) Int. Cl.³: G 02 C 13/00

(30) Priority: 27.03.81 JP 44778/81

(43) Date of publication of application:
06.10.82 Bulletin 82/40

(84) Designated Contracting States:
BE DE FR GB IT NL SE

(71) Applicant: Hoya Lens Corporation
25, Kowada Itsukaichi-machi Nishitama-gun
Tokyo(JP)

(72) Inventor: Akaba, Hayao
18-12, Hajimacho-2-chome
Akishima-shi(JP)

(72) Inventor: Wada, Toyoji
1050, Itsukaichi, Itsukaichicho
Nishitama-gun Tokyo(JP)

(72) Inventor: Ii, Tadao
2913-7-326, Naramachi
Midori-ku Yokohama(JP)

(72) Inventor: Namatame, Hideo
105-7, Yano
Ome-shi(JP)

(74) Representative: Blanco White, Henry Nicholas et al,
ABEL & IMRAY Northumberland House 303-306 High Holborn
London WC1V 7LH(GB)

(54) **Method of manufacturing spectacles.**

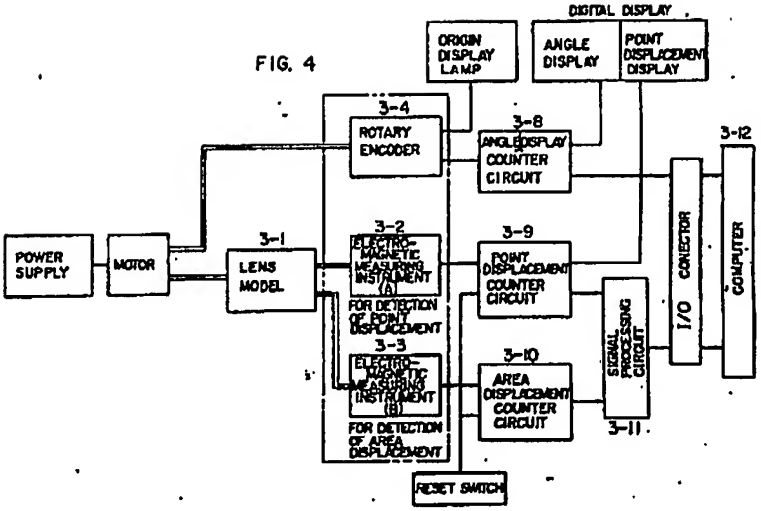
(57) Method of manufacturing spectacles having lenses which can be fitted in a frame suited for a user in accordance with an automatic design program prepared in consideration of recipe prescribed for the user. The recipe is first incorporated in an automatic lens program. Next, information of a selected frame is obtained from a proper lens model (1-4, 2-4) and processed by a computer (3-12) to thereby design an optimum lens. Subsequently, a raw lens material is subjected to cutting, abrading and the like processing in accordance with the results obtained from the processing by the computer (3-12). The finished lenses are then fitted in the frame to thereby fabricate the spectacles fitted with the lenses having a minimum edge thickness and held by the desired frame.

EP 0 061 918 A1

./...

Croydon Printing Company Ltd.

FIG. 4


DIGITAL DISPLAY
ORIGIN DISPLAY LAMP
ANGLE DISPLAY
POINT DISPLACEMENT DISPLAY
3-4
ROTARY ENCODER
3-8
ANGLE DISPLAY COUNTER CIRCUIT
3-12
POWER SUPPLY
MOTOR
3-1
LENS MODEL
3-2
ELECTRO-MAGNETIC MEASURING INSTRUMENT (A)
FOR DETECTION OF POINT DISPLACEMENT
3-9
POINT DISPLACEMENT COUNTER CIRCUIT
3-3
ELECTRO-MAGNETIC MEASURING INSTRUMENT (B)
FOR DETECTION OF AREA DISPLACEMENT
3-10
AREA DISPLACEMENT COUNTER CIRCUIT
SIGNAL PROCESSING CIRCUIT
3-11
I/O CONECTOR
COMPUTER
RESET SWITCH

0061918

METHOD OF MANUFACTURING SPECTACLES

The present invention relates in general to a method of manufacturing spectacles. In more particular, the invention concerns a method of fabricating glasses or spectacles which method includes steps of measuring a lens model or pattern representative of shape and size of a frame of the spectacles in which finished lens is to be fitted, inputting the information of the lens model or pattern and optometrial information prescribed by an ophthalmologist or eye doctor into a computer for processing both informations in accordance with a predetermined automatic lens designing program, preparing the lens on the basis of the design data or processing information thus obtained by cutting, abrading and/or the like processing, and fitting the lens thus finished in the frame of spectacles.

In order to realize spectacles or glasses in accordance with recipe prescribed by opthalmologist or eye doctor so that the spectacles assure comfortableness and proper visual aid to the user, precise information of the frame of spectacles is indispensable in addition to the recipe prescribed by the eye doctor.

Heretofore, lens material for spectacles are in a circular form and labelled with outer diameters for facilitating commercial handlings. The lens material is profiled so as to be fitted in a selected

frame. Hitherto known method of preparing lenses for fitting it in the selected frame suffers various shortcomings among which the following can be mentioned.

1) Extra portion of the lens material which has to be removed for preparing a specific lens is also prepared optically effective.

2) A convex lens made from the lens material tends to present an edge thickness which is not suited for being fitted in the frame. In other words, the prepared lens often present, the edge thickness which is not optimum for fitting the lens in the frame.

When a lens or frame model (pattern) copying the shape and size of the lens to be prepared is used, following advantages can be involved.

a) Lens can be manufactured with a high yield.

b) Reduction of stocked lens materials (i.e. raw lens) can be attained.

c) Spectacles can be realized in light weight.

d) Costs can be reduced.

Accordingly, it is first intended with the present invention to obtain the information of a selected frame by measuring with precision a corresponding lens or frame model or pattern. The lens is then prepared in accordance with the frame information and the recipe prescribed by eye doctor so that the lens of a minimum edge thickness can be snugly fitted in the selected frame, to thereby assure light weight of the assembled spectacles.

In the manufacture of the spectacles, lens materials or raw lenses having curved faces presenting predetermined powers and predetermined diameters (e.g. 60 mm, 65 mm and 70 mm) are preparatorily stocked. For preparation of the lens, a selected one of the raw lenses is profiled by using a lens model suited for the frame selected by the user and assembled in the frame. However, the lens processed according to the hitherto known method tends to present a great edge thickness, have a heavy weight and is lacking in smartness. Thus, the finished spectacles can not always assure comfortableness for the user.

Accordingly, an object of the present invention is to provide a method of preparing lens for spectacles which is evaded from the drawbacks of the hitherto known lens preparation by introducing a process of measuring the configuration and size of a frame selected by user and processing the measurement information as well as optometrical information with the aid of a computer, to thereby realize the lens of minimum edge thickness and hence the spectacles of light weight and smartness.

According to a first aspect of the invention, there is provided a method of manufacturing a lens for spectacles on the basis of an automatic designing program prepared in accordance with a recipe which comprises steps of preparing an automatic lens design program in accordance with a prescription for a user,

obtaining frame information of a desired frame in which finished lenses are to be fitted on the basis of a lens model, deriving optimum lens design data through processing of the frame information by computer in accordance with the lens design program, and preparing and finishing a lens by cutting, abrading or the like processing of a lens material in accordance with the optimum lens design data.

According to a second aspect of the invention, there is provided a method of manufacturing lenses to be fitted in a frame of spectacles on the basis of an automatic design program prepared in accordance with a recipe prescribed for a user which comprises steps of preparing first the automatic design program in accordance with the recipe prescribed for the user, obtaining information of a lens frame from a lens model, processing the frame information in accordance with the automatic lens design program by a computer to thereby make available optimum lens design information, and processing a lens in accordance with the optimum lens design information by cutting and abrading a raw material of the lens.

According to a third aspect of the invention, there is provided a method of manufacturing spectacles on the basis of an automatic design program prepared in accordance with a recipe prescribed for a user which comprises steps of preparing first an automatic lens program in accordance with recipe prescribed for the

user, obtaining desired information of a frame in which the lenses are fitted with the aid of a lens model, designing optimum lenses by processing the frame information in accordance with the program by a computer, processing a lens material in accordance with data available from the output of the computer, and fitting the finished lenses in the frame.

Other objects, features and advantages of the present invention will become more apparent from the following description of preferred embodiments thereof taken in conjunction with the accomapnying drawings, in which:

Fig. 1 is a view to illustrate a process of preparing a lens according to a hitherto known adjusting method;

Fig. 2 is a view to illustrate a process of preparing a lens in accordance with a method of the present invention;

Fig. 3 is a view to illustrate schematically a structure of an apparatus for measuring a lens model used in carrying out the method of preparing a lens of glasses or spectacles according to the invention; and

Fig. 4 is a block diagram showing a circuit arrangement of an automatic lens design system for carrying out the lens preparing method according to the invention.

Now, the invention will be described in concrete by referring to Fig. 1. For making up a lens

for glasses or spectacles, a peripheral edge portion of a polished lens 1-3 having a predetermined diameter is abraded or removed away for copying a profile of a lens mode 1-4 to thereby remove portions 1-2 and 1-2' indicated by hatched area, so that the finished lens can be fitted in a rim or frame. Thus, in the case of the lens for spectacles and in particular in the case of a convex lens, the processed lens thus presents a thicker peripheral edge. The spectacles prepared from such lenses fitted in a frame is not only lacking in smartness but heavy in weight, imposing a burden on the user. In an effort to evade such inconvenience, it has been attempted to start the lens processing from a raw lens having a smaller diameter. However, this means that selection of the frame or rim is undesirably restricted, making it difficult or impractical to use a frame of an increased size now in fashion.

Accordingly, it is contemplated with the invention to provide an apparatus for measuring with a high accuracy the lens model or frame model, whereby informations of the lens model concerning the shape and dimension are inputted to a computer together with optometrical information obtained through eye-examination of a user to thereby determine arithmetically various optical characteristics such as sphere power, cylinder power, prism power, cylinder axis, decentralization and so forth in accordance with a design program stored previously in the computer. The lens is made up or

abraded in accordance with the data thus obtained to thereby prepare a lens having an optimal thickness and thus suited for being fitted in a desired frame, as is illustrated in Fig. 2.

Next, description will be made on a method of measuring shape and dimension of a lens model or profile model according to the teaching of the present invention by referring to Figs. 3 and 4. The shape and size or dimension of selected frame is copied in a lens model (usually made of a plastic flat plate) which is then fixedly placed on a lens model supporting plate (not shown) disposed above a motor 3-5. Subsequently, electromagnetic length measuring scale instruments 3-2 and 3-3 are brought into contact with peripheral edge portions of the lens model. In this case, care should be taken so that the lens model be positioned in a predetermined starting disposition. Usually, the lens model is located with the upper side atop. Subsequently, a power supply circuit shown in Fig. 4 is closed to initiate the operation of the motor 3-5 interlocking with the lens model. Rotation angle of the motor shaft is detected by a rotary encoder 3-4 which is operatively coupled to a gear wheel 3-6 mounted fixedly on the motor shaft by way of an interposed gear wheel 3-7 and is supplied to a computer through an angle counter circuit 3-4. The length measuring instruments are placed continuously in contact with the periphery of the rotating lens model and adapted to measure the distance

R between the center and the periphery of the lens model as well as the distance R' between the meridian (A-A') and a scale plate MP connected to the electromagnetic measuring instrument 3-3, as the result of which detection signals representative of the point displacement (R) and the area displacement (R') are produced from the electromagnetic measuring instruments 3-2 and 3-3. These detection signals are supplied to a signal processing circuit 3-11 by way of a counter circuit to be combined into a synthesized signal which is then supplied to the computer 3-12 together with the rotation angle signal mentioned above.

Additionally, optometrical information obtained through eye-examination is converted into signals representative of the various optical characteristics mentioned above in accordance with a predetermined program to be used in the computer together with the measurement data derived from the measurements of the lens model for arithmetic operation executed in accordance with a previously prepared lens designing program to thereby obtain data such as convex and concave curvatures, center thickness excentricity, diameter and the like required for processing the lens so that a minimum lens thick can be attained. The making-up or processing of the lens is conducted on the basis of the data thus obtained. The finished lens then presents a minimum thickness and a minimum diameter and can be snugly fitted in a selected frame with removal quantity of

the peripheral portion through abrading being decreased to a minimum.

In this way, preparation of the lens can be accomplished with an enhanced precision by virtue of the arithmetic processing of the measurement data and the optometrical data by the electric computer, whereby there is obtained a lens which can be snugly fitted in a selected frame and presents a light weight as well as smartness.

Fig. 4 shows in a block diagram a circuit arrangement for carrying out the lens preparing method according to the invention with emphasis being put on a circuitry for measuring the lens model. The apparatus for measuring the lens model copying a selected frame comprises a lens model rotating unit, a detecting unit and a display unit. Ends of movable contact rods of the electromagnetic measuring instruments 3-2 and 3-3 are brought into contact with the lens model in the manner described hereinbefore, and data as required are read out from a digital display. As the motor is driven, the lens model is rotated at a low speed, whereby the contact rods of the electromagnetic measuring scale instruments are displaced by following the profile of the lens model. On the other hand, the rotation angle with reference to a horizontal center axis is recorded in an angular distance of 2° to 5°, while the linear displacements of the contact rods are measured by means of potentiometers or linear encoder.

Thus, informations of the lens model such as rotation angle, point displacement and area displacement are obtained in a polar coordinate display. The circuit includes interfaces for directly loading data into the computer 3-12 in addition to the digital display and a digital printer so that the data processing can be carried out at a high speed in accordance with the automatic lens design program.

In this connection, it is noted that preparation of the design data table is impossible with only prescription by the ophthalmologist. Further, the appropriate lens design can be accomplished satisfactorily only when the frame profile is considered in addition to the prescription by the ophthalmologist. The approximate expression adopted heretofore is substantially of no use to this end. Accordingly, there exists a demand for the automatic lens design program which is so prepared as to allow the high speed processing with an enhanced accuracy.

According to the invention, the apparatus for measuring the lens model is combined with an appropriate computer such as, for example, Model ICUA-AA available from Fujitsu Co. in Japan, whereby the lens processing data table is prepared through arithmetic operation on the measurement information of the lens model and the prescription data loaded in the computer. Cutting and abrading of a raw lens are then executed on the basis of the data table thus obtained to thereby prepare

the lens for glasses which can be snugly fitted in a desired frame and has a minimum peripheral thickness.

WHAT IS CLAIMED IS:

1. A method of manufacturing a lens for spectacles on the basis of an automatic designing program prepared in accordance with a recipe; comprising the steps of: preparing an automatic lens design program in accordance with a prescription for a user; obtaining frame information of a desired frame in which finished lenses are to be fitted on the basis of a lens model (3-1); deriving optimum lens design data through processing of said frame information by a computer (3-12) in accordance with said lens design program; and preparing and finishing a lens by cutting, abrading or the like processing of a lens material (1-3) in accordance with said optimum lens design data.

2. A method of manufacturing lenses to be fitted in a frame of spectacles on the basis of an automatic design program prepared in accordance with a recipe prescribed for a user, comprising the steps of: preparing first the automatic design program in accordance with the recipe prescribed for the user; obtaining information of a lens frame from a lens model (3-1); processing said frame information in accordance with said automatic lens design program by a computer (3-12) to thereby make available optimum lens design information; and processing a lens in accordance with said optimum lens design information by cutting and abrading a raw material (1-3) of the lens.

3. A method of manufacturing spectacles on the

basis of an automatic design program prepared in accordance with a recipe prescribed for a user, comprising the steps of preparing first an automatic lens program in accordance with recipe prescribed for the user; obtaining desired information of a frame in which the lenses are fitted with the aid of a lens model (3-1); designing optimum lens by processing said frame information in accordance with said program by a computer (3-12), processing a lens material in accordance with data available from the output of said computer (3-12); and fitting the finished lenses in the frame.

FIG. 1

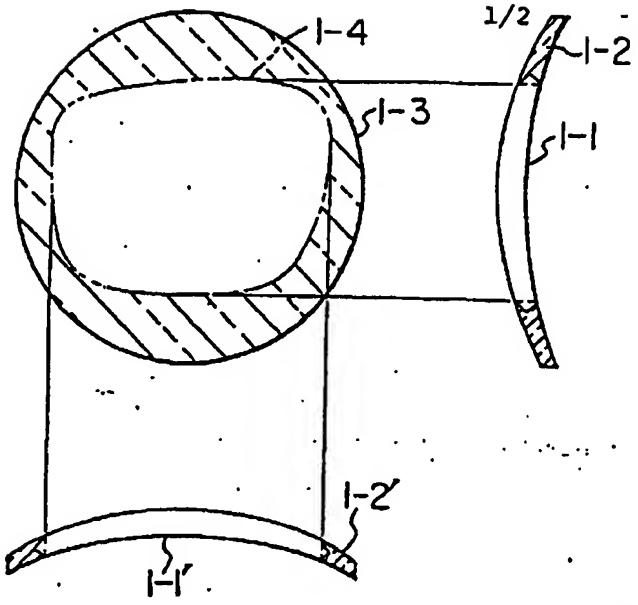


FIG. 2

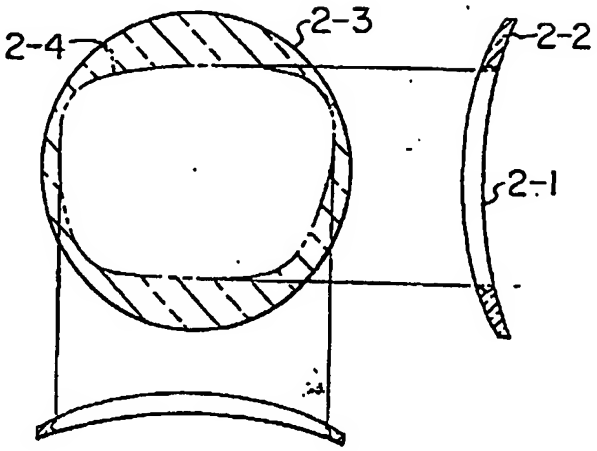
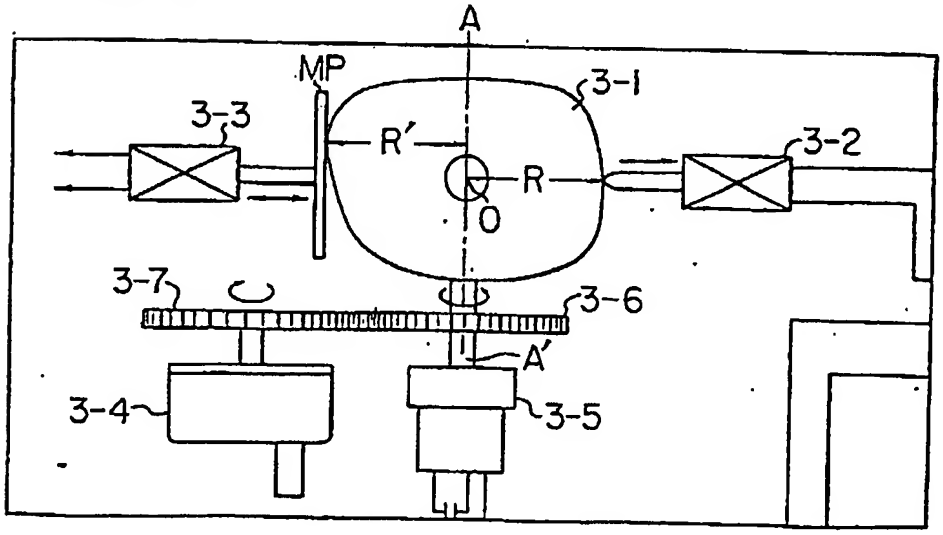


FIG. 3



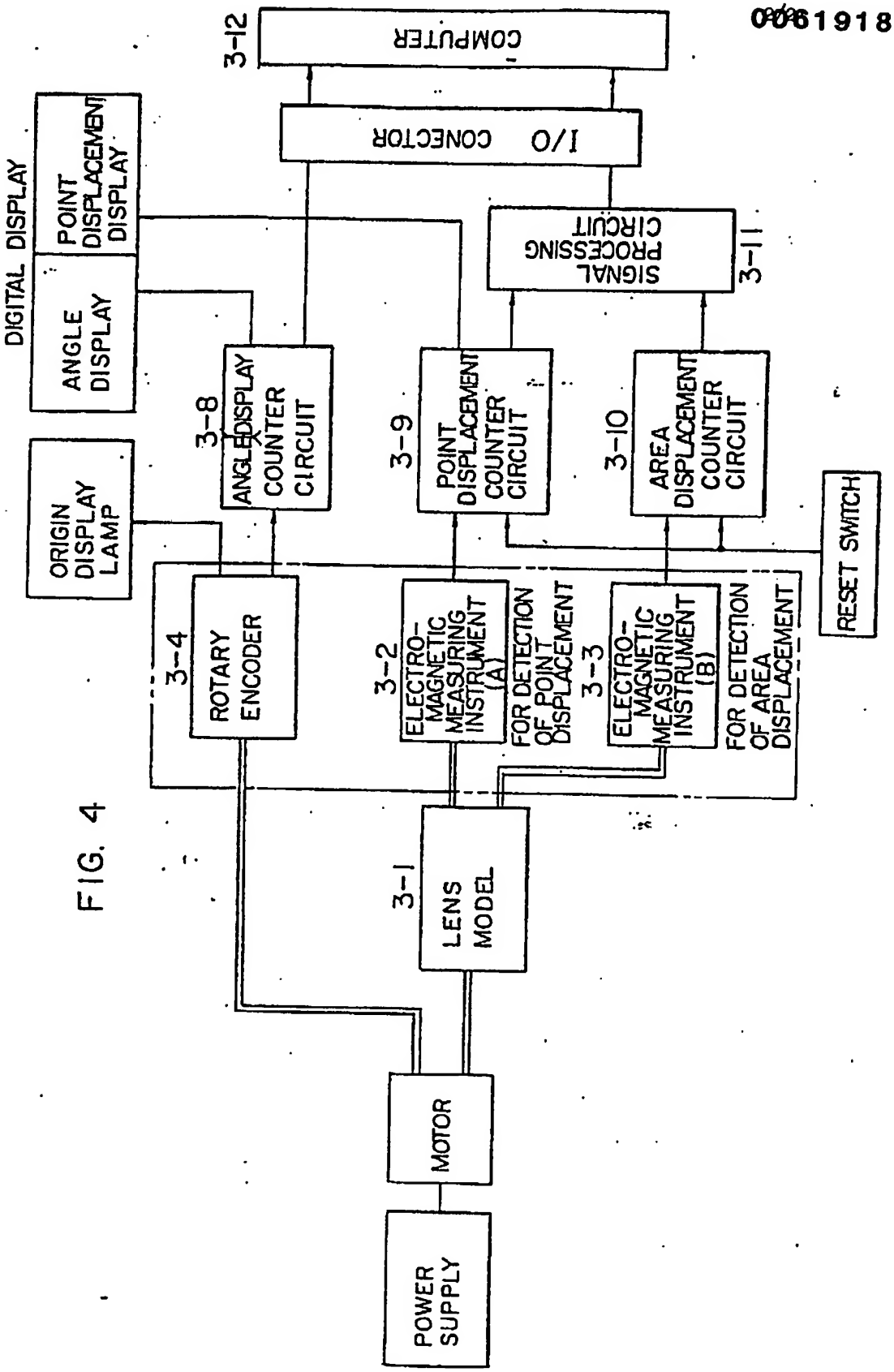

3-12
COMPUTER
I/O CONNECTOR
SIGNAL PROCESSING CIRCUIT
3-11
DIGITAL DISPLAY
POINT DISPLACEMENT DISPLAY
ANGLE DISPLAY
ORIGIN DISPLAY LAMP
3-8
ANGLE DISPLAY COUNTER CIRCUIT
3-9
POINT DISPLACEMENT COUNTER CIRCUIT
3-10
AREA DISPLACEMENT COUNTER CIRCUIT
RESET SWITCH
3-4
ROTARY ENCODER
3-2
ELECTRO-MAGNETIC MEASURING INSTRUMENT (A)
FOR DETECTION OF POINT DISPLACEMENT
3-3
ELECTRO-MAGNETIC MEASURING INSTRUMENT (B)
FOR DETECTION OF AREA DISPLACEMENT
3-1
LENS MODEL
MOTOR
POWER SUPPLY

FIG. 4